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For licensing information write to the Secretary, Federal Communications Commission, Washington 25, D. C., indicating type of equipment and proposed use.

The fact that this transmitter is operable on certain frequencies does not constitute authorization for use of those frequencies. It is the personal responsibility of every operator to keep himself informed on current regulations governing frequency allocations, and the types of communication services permitted therein, granted for use under his class of license.

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ILLUSTRATIONS

Figure 1. ST-203-A Front View

RADIO TRANSMITTER ST-203-A

SPECIFICATIONS

Type of Emission	Radiotelephony (A3)
Amplifier Plate Power Input	25 Watts (Conservative Rating)
Frequency Range	27–32 Megacycles
Frequency Control	Quartz Plate
Output Circuit	Tunable Pickup Link
Power Requirements	High Voltage.... 400–500 VDC @ 200 Ma. Low Voltage.... 6 VAC/DC @ 2.8 Amp.
Oscillator Tube (VT1)	Type 6V6
Amplifier Tube (VT2)	Type 2E26
Speech Amplifier Tube (VT3)	Type 6J5
Modulator Tube (VT4)	Type 6V6
Modulator Tube (VT5)	Type 6V6
Overall Dimensions with Fixtures	8⅝″ W. x 7⅜″ H. x 6¾″ D.
Unit Weight with Tubes and Crystals	9¼ Pounds

GENERAL

Stancor Model ST-203-A Radio Transmitter provides telephonic emission in the frequency range between 27 and 32 megacycles. Although primarily intended for mobile operation, it is also useful for fixed station service.

Electrically, the ST-203-A is designed to be powered from a dynamotor or vibrator supply for mobile work, or an AC supply for transmission from a fixed location. Either type of operation may be realized by plugging the output of the appropriate power supply into the ST-203-A receptacle. Mechanically, the transmitter is firmly attached to a base mounting plate by means of spring loaded, catch fasteners which are easily released for quick removal of the unit to another location for AC or DC operation.

Periods of transmission and standby are controlled by a press-to-talk switch mounted on the microphone. Operating control of the transmitter is available at a remote position or at the unit itself.

Oscillator, amplifier and antenna tuning knobs, as well as crystal and meter switches, are conveniently located at the front of the unit. Here, too, are the microphone and meter jacks and the coaxial connectors to the antenna system and receiving equipment.

In consideration of safety to the operator, external exposure of high voltage is prevented. Control circuits are arranged so that, should the connector plug from the power supply system be removed from the ST-203-A chassis while it is in operation, the high voltage will automatically turn off. Even the metering circuit is grounded to the chassis.

Although it is expected that a one-quarter wavelength, vertical whip antenna will most commonly be used in mobile installation, any suitable type of antenna system fed by small size coaxial cable may be applied to the ST-203-A.

ACCESSORIES

Accessories needed, but not furnished, with the ST-203-A Kit for operation as a mobile transmitter are:

TUBES— One 2E26, one metal 6J5, and three metal 6V6's.

CRYSTALS— Quartz crystal plates mounted in plug-in type housings. The ST-203-A accommodates two of the popular type crystal holders having .095″ diameter pins centered .487″ apart. Crystal frequencies should be one-fourth of the desired output channel frequencies.

MICROPHONE— 200 ohm, single button, carbon microphone with press-to-talk switch, three wire cord, and three conductor plug with .205″ diameter tip rod. (Representative type: U.S. Signal Corps T-17-B).

METER— 0–100 DC milliammeter wired to standard two conductor, phone plug.

DYNAMOTOR— 6 volts DC input to 400–500 volts DC output @ 200 Ma. (intermittent service) dynamotor with filters, control relay and heavy battery cables. (Representative type: U.S. Signal Corps PE-103-A with Cannon No. P 8-CG-12S connector plug).

ANTENNA SYSTEM— One-quarter wavelength long whip antenna with insulating mounting base. Also required is sufficient RG-58/U coaxial cable to run from antenna and receiver to the ST-203-A.

REMOTE CONTROL— Consists of a three conductor microphone jack, SPST toggle switch, green jewel pilot light assembly, (optional), red jewel pilot light assembly (optional), and wiring leads needed to form extension cable.

CIRCUIT EXPLANATION

Roughly, the circuits of the ST-203-A may be divided into two major sections, the radio frequency channel, which generates the transmitting carrier wave and the audio frequency channel, which superimposes speech intelligence upon the carrier wave. In addition, there are circuit facilities for the distribution and control of electrical power.

Throughout the discussion in this section, constant reference is made to the ST-203-A schematic diagram, Figure 5.

A 6V6 beam tetrode, VT1, is employed in a crystal oscillator circuit having controlled regeneration to provide harmonic output at twice the crystal frequency. An optimum degree of regeneration is developed in the cathode circuit by inductor L1 and throttling capacitor C2, which together form an impedance common to both plate and grid circuits of the tube. In this manner, excitation for the RF amplifier is generated with a single stage and without resorting to special "overtone" type quartz plates.

Since the crystal frequency should be one-fourth of the carrier frequency, crystals calibrated between 6.75 and 8 megacycles will fall within the rated output frequency range of 27 to 32 megacycles. For example: A 7.3 megacycle crystal should be used for an output channel of 29.2 megacycles in the amateur phone band allocation. However, it should be borne in mind that the oscillator merely doubles the crystal frequency.

Because of its high power gain and superior VHF characteristics, a 2E26 beam tetrode, VT2, is employed in the RF amplifier output stage in which it functions as a modulated, Class C, frequency doubler. The audio modulating voltage is applied to both plate and screen elements of the tube.

In designing the ST-203-A, the 2E26 was tried both as a straight amplifier and as a frequency doubling amplifier. By operating the tube far into the Class C region (approximately eight times cut-off) and supplying sufficient RF excitation to the grid (easily obtained from the 6V6 oscillator), a plate circuit efficiency in the vicinity of 70% was attained, comparing favorably with the degree of efficiency expected from a straight amplifier. Therefore, it was decided to take advantage of the extra stability (freedom from self-oscillation) offered by a frequency doubling stage and at the same time complete the process of frequency multiplication required to deliver the desired output channel frequency.

The comparatively high bias required is automatically developed across resistor R4 by grid-cathode rectification (by VT2) of the excitation generated by the oscillator.

Power output from VT2 is transferred to the antenna system by means of a pick-up winding inductively coupled to the "cold" end of plate coil L3 and by variable tuning capacitor C10, which adjusts loading of the antenna system upon the RF amplifier. Contacts #1, #2 and #3 of relay RY switch the coaxial antenna line between the output of the transmitter and the input of the receiving equipment in accordance with the press-to-talk actuation.

To facilitate adjustment of the ST-203-A, the jack, J1, connected between the cathode of VT2 and ground, permits plugging in a DC milliammeter as a tuning indicator. The meter will show either amplifier grid or cathode current as determined by the position of switch S2. With this switch open, the screen potential is removed from the tube suppressing the flow of plate and screen currents. In this condition, only amplifier grid current prevails, assuming proper adjustment of L2 and C3, and is shown by the meter. Thus, the oscillator may be tuned to give maximum amplifier grid current without danger of abuse to VT2 due to excessive off-resonance plate current. When ready to resonate the amplifier tank circuit, L3 and C8, the closing of S2 applies the required screen potential allowing plate and screen currents to flow as recorded by the meter. When all adjustments have been finished, oscillator, amplifier and antenna tuning, the meter plug may be removed from J1 without interrupting the cathode circuit of VT2 as the circuit remains completed by means of the circuit closing feature of this jack.

A 6J5 triode, VT3, is employed in a grounded-grid speech amplifier circuit. Since the microphone connects in series with the tube's cathode circuit, exciting current is automatically furnished to its carbon button. In addition, the cathode impedance of VT3 approximates that of the microphone eliminating the need for a microphone transformer.

Two 6V6 beam tetrodes, VT4 and VT5, are employed in a conventional push-pull, Class A_1, audio frequency power amplifier for high level modulation of the Class C, RF amplifier.

Relay RY, besides performing the antenna changeover function, turns on the supply of high voltage when actuated by the press-to-talk button. Although most generally contacts #5 and #6 of RY will be used to control the high voltage supply, contacts #4, #5 and #6 provide means for simultaneously "making" one circuit while "breaking" another providing that a common lead to #5 may exist between the two circuits. Proper operation of the relay coil on either 2 volts DC or 6.3 volts AC is achieved by including the resistance of R11 in the control circuit on DC operation and excluding it on AC operation. Appropriate wiring of the power plugs from the AC and DC power supplies accomplishes correct circuiting of R11.

Plate and screen potentials for VT1, VT3, VT4 and VT5 are reduced to the desired operating level by means of resistors R9 and R10. Where output voltage of the power supply to be employed is in the range from 400 to 500 volts DC, the total series resistance of R9 and R10 is wanted in the circuit. But where the available supply delivers less than 400 volts DC, only one of these resistors should remain in the circuit.

ASSEMBLY

Before starting actual assembly of the ST-203-A, as described under CONSTRUCTION STEPS, a few general instructions should be carefully noted.

All parts should be checked against the packing list, schematic diagram, and photographs for identity and location.

Mounting and wiring operations should be performed in the order listed.

Hardware should be used exactly as specified.

Each prepared lead should be identified by its length and color for wiring into the particular circuit for which it was intended.

In making a soldered junction, the wire should be well wrapped and snugly shaped around the contact. Rosin core solder should be adequately, but not excessively applied along with sufficient heat from the soldering iron to result in a smooth flow into the joint. Wiping off superfluous rosin with a rag immediately after the melted solder has set produces a clean looking connection.

The ST-203-A is packed with transformers T1 and T2 mounted on the chassis. To protect metal finish, a pad may be used to separate the chassis from the work bench. Reference made to the position of a component assumes the same orientation as viewed on appropriate photograph.

CONSTRUCTION STEPS

1. Mount both crystal sockets using the 4–40 by 7⁄16″ long screws and 4–40 nuts. These nuts should be seated between the shoulders of the crystal sockets, beneath the chassis, and the screws tightened, with caution, from above.

2. Mount the octal, mica-filled bakelite, sockets for VT1 and VT2 with their keyways facing the rear of the chassis. Each socket requires a 6–32 by ¼″ long screw, lockwasher, and nut for its forward mounting hole and

a 6–32 by ¼″ long screw, two soldering lugs, and nut for its mounting hole near the keyway. Tighten hardware after having positioned lug ends to oppose each other against the body of socket.

3. Mount the octal, black bakelite, socket for VT3, with keyway to the right, using a 6–32 by ¼″ long screw, lockwasher, and nut for its left mounting hole and a 6–32 by ¼″ long screw, soldering lug, and nut for its right mounting hole. Tighten hardware with the soldering lug end facing the rear of the chassis.

4. Mount the octal, black bakelite, sockets for VT4 and VT5 with their keyways facing to the left of the chassis. Each socket requires a 6–32 by ¼″ long screw, lockwasher, and nut for its right mounting hole and a 6–32 by ¼″ screw, soldering lug, and nut for its left mounting hole. Tighten hardware after having positioned each lug end toward the front of the chassis.

5. Mount the octal, black bakelite, socket for SO1 with keyway to the right using a 6–32 by ¼″ long screw, lockwasher, and nut for its left mounting hole and a 6–32 by ¼″ long screw, soldering lug, and nut for its right mounting hole. Tighten hardware with the soldering lug end facing toward T2.

6. Mount resistors R9 and R10 against the inside of the chassis rear apron with terminal lugs facing each other using four 6–32 by ¼″ long screws, lockwashers and nuts.

7. Mount the polystyrene bushing in the ¼″ diameter hole near the left, front corner of the chassis. The provided nut should be carefully tightened from below with an appropriate wrench. Remove the short piece of bus wire by pulling it straight out with a pair of pliers.

8. Affix the rubber grommet to the ¼″ diameter hole to the right of the polystyrene bushing.

9. Fasten the mounting bracket atop the front, left corner of the chassis using hardware in the following order:

At left rear mounting hole, place a 6–32 by ¼″ long screw and soldering lug, with its end facing corner of bracket, into hole from above and add a lockwasher and nut to the screw below the chassis.

At corner mounting hole, use a 6–32 by ¼″ long screw, lockwasher and nut.

For remaining mounting hole at right, place a 6–32 by ¼″ long screw into hole from above and add a soldering lug, with its end facing the corner mounting screw, and a nut below the chassis.

To the hole on the triangular side of the bracket, secure a soldering lug to the inner bracket surface, with lug end facing rear, using a 6–32 by 1/4" long screw and nut.

10. Mount catch fasteners to sides of chassis with 6–32 by 3/8" long screws, lockwashers, and nuts using the eared, spring-metal pieces between fasteners and chassis.

11. Mount the coaxial chassis connectors to front apron of chassis, with their grounding lugs facing center of chassis, using 6–32 by 1/4" long screws, lockwashers and nuts.

12. Mount SPST toggle switch S2 at the meter switching position adjusting the hexagonal nut on the shank so that, with the lockwasher added, just sufficient thread length protrudes through the panel hole to fully engage the knurled nut used on the front. While tightening, hold switch body vertically with lugs near VT2.

13. Mount SPDT toggle switch S1 at the crystal switching position adjusting the hexagonal nut on the shank so that, with the lockwasher added, just sufficient thread length protrudes through the panel hole to fully engage the knurled nut used on the front. While tightening, hold switch body vertically with side lugs near crystal sockets.

14. Using #18 bus wire, run a short piece through the ground lug of each coaxial chassis connector to the soldering lug provided nearby. Solder all three points.

15. Run a piece of #18 bus wire from the end hole of contact #2 of VT2 to the inner hole of the nearest soldering lug. At this time, solder at tube contact only.

16. Run a piece of #18 bus wire from the inner hole of contact #8 of VT2 to the end hole of the nearest soldering lug. At this time, solder at lug only.

17. Run a piece of #18 bus wire from the inner hole of contact #1 of VT1 through the inner hole of contact #2 of VT1 to the inner hole of the nearest soldering lug. As yet, do not solder.

18. Run a piece of #18 bus wire through the rear lugs of the crystal sockets, the end hole of the free lug at VT1, and the inner hole of contact #5 of VT3. At this time, solder at all but the last named point.

19. Run a piece of #18 bus wire from the inner hole of contact #1 of VT3 through the inner hole of contact #2 of VT3 to the end hole of the nearest soldering lug. At this time, solder at contact #1 only.

20. Run a piece of #18 bus wire from the inner hole of contact #1 of VT4 through the inner hole of contact #2 of VT4 to the end hole of the nearest soldering lug. At this time, solder at contact #1 and at the soldering lug, but not at contact #2.

21. Run a piece of #18 bus wire from the inner hole of contact #1 of VT5 through contact #2 of VT5 to the end hole of the nearest soldering lug. At this time, solder at contact #1 and at the soldering lug, but not at contact #2.

22. Using #18 bus wire, join the end hole of the #1 contact of SO1 to the end hole of the nearest soldering lug. Solder at both points.

23. Run a piece of #18 bus wire from the right side lug of S1, near the chassis, to the free lug on the closest crystal socket. Solder at both points.

24. Run a piece of #18 wire from the remaining right side lug of S1 to the free lug on the cystal socket to the right. Solder at both points.

25. Using #18 bus wire, join the inner holes of contacts #1, #4, and #6 of VT2. At this time, solder at contacts #4 and #6 only.

26. Using a 4½" yellow lead, connect from the end hole of contact #2 of SO1 to the end hole of contact #7 of VT5. At this time, solder the first mentioned contact only.

27. Using a 4" yellow lead, connect from the inner hole of contact #7 of VT5 to the end hole of contact #7 of VT4. Solder at the first mentioned contact only.

28. Using a 5" yellow lead, connect from the inner hole of contact #7 of VT4 to the inner hole of contact #7 of VT2. Solder at the first mentioned contact only.

29. Using a 5" yellow lead, connect from the end hole of contact #7 of VT2 to the inner hole of contact #7 of VT1. At this time, do not solder at either point.

30. Using a 2½" yellow lead, connect from the end hole of contact #7 of VT1 to the end hole of contact #7 of VT3. Solder at both points.

31. Using a 4" red-blue lead, connect from the end hole of contact #3 of SO1 to the left terminal of R10. Solder at first mentioned contact only.

32. Trim down the yellow lead from T2 allowing at least 5" to remain. Connect it to the left terminal of R10 and solder.

33. Using a 6½" red-blue lead, connect from the right terminal of R10 to the left terminal of R9. Solder at both points.

34. Using a 6" red lead, connect from the right terminal of R9 to the inner hole of contact #4 of VT5. Solder at the first mentioned contact only.

35. Using a 3½" red lead, connect from the inner hole of contact #4 of VT5 to the inner hole of contact #4 of VT4. As yet, do not solder at either point.

36. Trim down the red lead from T1 allowing at least 3½" to remain. Connect it to the end hole of contact #4 of VT5 but do not solder.

37. Trim down the red lead from T2 allowing at least 4" to remain. Connect it to the end hole of contact #4 of VT5 and solder.

38. Using a 4½" red lead, connect from the inner hole of contact #4 of VT4 to the inner hole of contact #6 of VT1. As yet, do not solder at either point.

39. Insert C13 by connecting its positive lead to the end hole of contact #4 of VT4 and its negative lead to the end hole of contact #2 of VT3. Solder at both points.

40. Using a 4" red lead, connect one end to the inner hole of contact #6 of VT1. For the time being, the other end of this lead remains free but later connects to the rotor terminal of C3. As yet, do not solder at contact #6.

41. Trim down the blue lead from T1 allowing no less than 3½" to remain. Connect it to the end hole of contact #3 of VT3 and solder.

42. Trim down the green lead of T1 allowing no less than 4½" to remain. Connect it to the end hole of contact #5 of VT4 and solder.

43. Trim down the yellow lead from T1 allowing no less than 3½" to remain. Connect it to the end hole of contact #5 of VT5 and solder.

44. Trim down the black lead of T1 allowing no less than 5" to remain. Connect it to the end hole of contact #2 of VT5 and solder.

45. Trim down the blue lead of T2 allowing no less than 5" to remain. Connect it to the end hole of contact #3 of VT4 and solder.

46. Trim down the brown lead of T2 allowing no less than 4" to remain. Connect it to the end hole of contact #3 of VT5 and solder.

47. Trim down the green lead of T2 allowing no less than 6½" to remain. Connect it to the right lug of S2 but do not solder.

48. Using a 7½" red-blue lead, feed one end from the top through the chassis grommet and connect it to the right terminal of S2. Solder. The free end of this wire, above the chassis, will be used later.

49. Before mounting J2 at the microphone jack position on the panel, the following preparations should be made:

Parallel R6 and C11 by wrapping the resistor leads around those of C11, close to where they emerge from the capacitor, and solder. Connect the negative lead of R6-C11 combination to the #1 terminal of J2, that which will contact the microphone's carbon element, leaving about one-half inch of lead length for clearance between C11 and the jack lug to which it connects. Add one end of a 14" green lead to the same #1 jack terminal and solder.

Connect one end of a 6¾" red-yellow lead to the #2 terminal of J2, that which will contact the microphone's control switch, so that the lead breaks away to the right when viewing the rear of the jack with the #2 terminal at the top. Solder.

Having placed a lockwasher on the threaded shank of J2, feed it through the panel hole marked MIC, holding the jack so that the tip contacting spring is close to the chassis. Add the flat washer and nut at the front and tighten.

50. Route the long green lead from J2 to the rear along the bend in the chassis and around the corner to the left, between R9 and the chassis, and solder to the end hole of contact #5 of SO1. Dress lead into corner near J2 and along route to SO1 where it forms a loop to the left of contact #5.

51. Route the red-yellow lead from J2 along the chassis bend and around VT3 to the inner hole of contact #4 of VT3. Dress lead into corner near J2 but do not solder at VT3.

52. Using a 10½" red-yellow lead, connect from the inner hole of contact #4 of VT3, routing between VT4 and VT5, to the end hole of contact #4 of SO1. Solder at the last mentioned point only. Dress lead for neat, square-cornered routing.

53. Using a 7½" brown-yellow lead, connect from the inner hole of contact #6 of VT4 to the inner hole of contact #6 of SO1. Do not solder at either point.

54. Mount resistor R11 by its leads between the end hole of contact #6 of VT4 and the end hole of contact #4 of VT3. Solder at both points.

55. Before mounting J1 on the panel, the following preparations should be made:

Connect one end of an 11" brown lead to the #1 terminal of J1, that which will contact the tip of the plug, so that the lead breaks away to the right when viewing the rear of the jack with the tip contacting spring to the left. Solder connection.

Having placed a lockwasher on the threaded shank of J1, feed it through the panel hole marked MTR, holding the jack so that the tip contacting spring is at the left. Add the flat washer and nut at the front and tighten.

56. Route the brown lead from J1 along the chassis bend down to VT3 and then sharply bend to the left running the lead between VT1 and VT3, along the chassis, to the end hole of contact #1 of VT2. As yet, do not solder. Dress one end of lead into corner near J2 and at the other end form a loop sweeping to the left of the VT2 contact.

57. Contacts #2 and #3 of J1 should be grounded to the chassis as well as contact #3 of J2. This is done by joining all three terminals together with a common piece of #18 bus wire and routing the wire from the corner near the jacks along the chassis bend to the inner hole of the soldering lug at VT3. Solder at all four points.

58. While holding the R6-C11 combination against the chassis bend between J2 and VT3, connect its positive lead to the inner hole of contact #8 of VT3. Do not solder.

59. Mount both R7 and C12 across VT3 by connecting them between the end holes of contacts #5 and #8 of VT3. Solder at both points.

60. Using a 4¼″ brown lead, connect from the inner hole of contact #8 of VT5 to the end hole of contact #8 of VT4. Solder at last mentioned point only.

61. Connect R8 between the end hole of contact #2 of VT4 and the end hole of contact #8 of VT5. Solder at both points.

62. Mount R1 across VT1 by connecting it between the end holes of contacts #1 and #5 of VT1, permitting the resistor lead to continue through the latter contact to join the left terminal of S1. Solder at all three points.

63. Mount R3 alongside VT1 by connecting it between the end holes of contacts #4 and #6 of VT1. Solder at last mentioned point only.

64. Mount C1 across VT1 by connecting it between the end hole of contact #4 and the inner hole of contact #8 of VT1. Solder at first mentioned point only.

65. Mount C2 alongside VT1 by connecting it between the end holes of contacts #2 and #8 of VT1. Do not solder at either point.

66. Mount R2 alongside C2 by connecting it between the end hole of contact #2 of VT1 and the end hole of contact #6 of VT3. Solder at first mentioned point only.

67. Mount L1 by connecting it between the end hole of contact #8 of VT1 and the end hole of contact #6 of VT3. Solder at both points.

68. Before mounting the relay, RY, the following preparations should be made:

Viewing the relay terminal board as shown pictorially on the schematic diagram, connect a 7½″ brown-yellow lead to terminal #7, so that it sweeps away to the left, and solder. Connect a 5½″ yellow lead to terminal #8, so that it sweeps away to the left, and solder. Connect a 7″ black-green lead to the #5 terminal, so that it sweeps downward, and solder. Connect a 6¾″ green-yellow lead to the #6 terminal, so that it sweeps downward, and solder.

Connect a 2″ length of #18 bus wire to the #1 terminal, so that it breaks away toward the viewer, and solder. Connect a 4″ length of #18 bus wire to terminal #3, so that it breaks away toward the viewer, and solder. Connect a 2″ length of #18 bus wire to the #2 terminal, so that it breaks away toward the viewer, and solder.

Carefully place the relay into its under-chassis position while holding all of the attached flexible leads straight back along the side of the relay and feeding the 4″ bus wire, from the #3 terminal, through the polystyrene bushing. Add the lockwasher and nut, which accompanies the relay, to the mounting screw protruding above the chassis and tighten securely.

69. Connect the free end of the yellow lead, from RY, to the inner hole of contact #7 of VT2 and solder.

70. Connect the free end of the brown-yellow lead, from RY, to the end hole of contact #6 of SO1 and solder. Dress lead so that it runs straight back to the chassis rear and forms a graceful loop to the left of the SO1 contact.

71. Connect the free end of the black-green lead, from RY, to the end hole of contact #7 of SO1 and solder. Dress lead so that it runs straight back to the chassis rear and forms a graceful loop to the left of the SO1 contact.

72. Connect the free end of the green-yellow lead, from RY, to the end hole of the #8 contact of SO1 and solder. Dress lead so that it runs straight back to the chassis rear and forms a graceful loop to the left of the SO1 contact.

73. Connect the free end of the bus wire, from the #2 terminal of RY, straight across to the center terminal of CR1, the connector marked ANT on the panel, and solder.

74. Connect the free end of the bus wire, from the #1 terminal of RY, straight across to the center terminal of CR2, the connector marked RCVR on the panel, and solder.

75. Place variable capacitor C3 behind the panel position marked OSC with its stator terminals toward the open chassis bottom. Fasten with two 4–40 by 7/16" long screws.

76. Mount C7 on edge alongside VT2 by connecting it between the end hole of contact #3 of VT2 and the end hole of the soldering lug behind it. Solder at the last mentioned point only.

77. Mount R5 atop C7, and alongside S2, by connecting it between the left terminal of S2 and the end hole of contact #3 of VT2. Solder at both points.

78. Mount C6 alongside VT2 by connecting it between the end holes of contacts #1 and #8 of VT2. Solder at first mentioned point only.

79. Mount R4 across VT2 by connecting it between the end holes of contacts #8 and #5 of VT2. Solder at first mentioned point only.

80. Mount C5 vertically by connecting it between the end hole of contact #5 of VT2 and the left stator post of C3. Solder at first mentioned point only.

81. Connect a piece of #18 bus wire from the end hole of contact #3 of VT1 directly to the right post of C3. Solder at both points.

82. Mount C4 on edge alongside VT1 by connecting it between the hole on the C3 rotor lug and the end hole of the soldering lug directly behind VT1. As yet, do not wrap C4's lead around the rotor lug of C3. Solder at the grounding lug only.

83. Carefully mount the oscillator plate coil, L2, horizontally by connecting it between the left stator post and the hole in the rotor terminal of C3. See photographs. Securely wrap the tinned lead ends around the C3 terminals, including at the rotor lug that of C4 and the free end of the red lead from contact #6 of VT1. Solder all leads at both terminals. Dress the position of L2 so that its axis is approximately 1¼" from the chassis. If necessary, bend the rotor terminal of C3 slightly away from stator plates for greater clearance.

84. Mount variable capacitor C10 behind the lower set of holes on the angle bracket with the stator facing upward. Use two 4–40 by 7/16" long screws.

85. Connect the bus wire protruding through the polystyrene bushing to the rotor terminal of C10 and solder. If necessary, bend the rotor terminal of C10 slightly away from the stator plates for greater clearance.

86. Mount variable capacitor C8 behind the upper set of holes on the angle bracket with the stator facing upward. Use two 4–40 by 7/16" long screws.

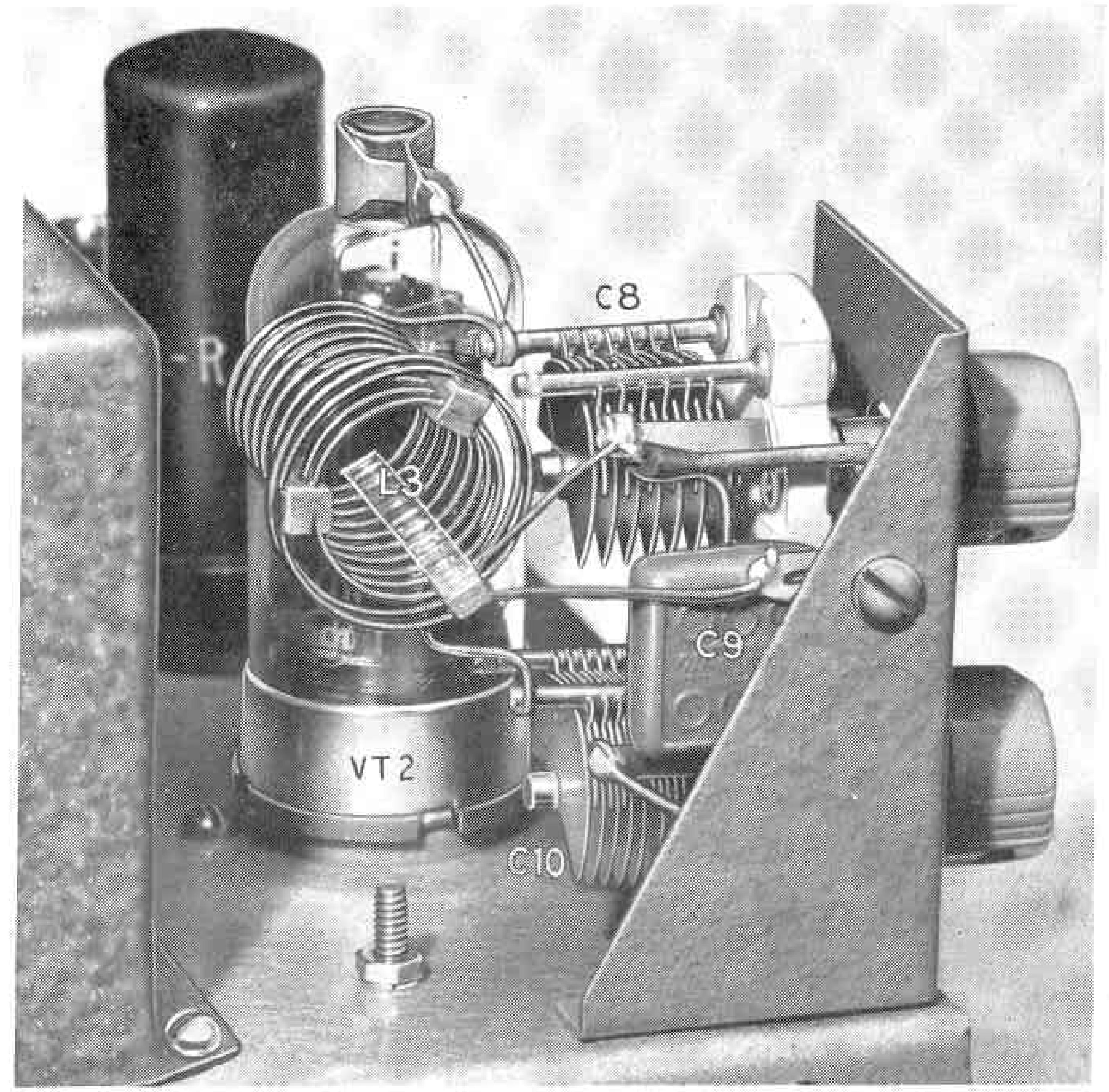


Figure 2. ST-203-A Amplifier Tank Assembly

87. Consult top view photograph and schematic diagram for proper orientation of amplifier plate coil L3. Then proceed to wire it into position in the following manner:

Take the tinned end of the L3 plate lead, form a tight loop around the end of the C8 stator post, near VT2, but do not solder.

After having routed the red-blue lead under the C10 mounting studs and upward along the corner of the angle bracket, feed its end through the hole in the C8 rotor terminal. Also, feed the tinned end of the L3 B plus lead through the same terminal hole, a sufficient amount to squarely position the coil. Flatly wrap both lead ends around the terminal, but do not solder. If necessary, bend the rotor terminal of C8 slightly away from the stator plates for greater clearance.

Tightly loop the tinned end of the link coil's antenna lead around the end of the C10 stator post, nearest to where the lead comes out of the coil, and solder.

Feed the tinned end of the link winding's outside lead through the end hole of the grounding lug on the angle bracket. Flatly wrap and solder.

88. Mount C9 vertically by connecting it between the grounding lug at the foot of the angle bracket and the C8 rotor terminal, at which point, the lead should be flatly wrapped alongside the other connections. Solder at both junction points. Position C9, away from C8 and C10, flatly against the inside of the angle bracket.

89. Take a short length of #18 bus wire and affix the plate clip to one end. Neatly wrap the other end around the C8 stator post, near VT2, so that it reaches the plate of the tube with a little slack, and solder.

90. Knobs may now be affixed to the rotor shafts of C3, C8, and C10. Tighten set-screws so that the capacitors' plates are completely meshed when knob pointers face directly to the right. The knobs then indicate increasing capacitance as they are rotated from left to right.

91. The bottom plate fastens under the chassis by means of four 6–32 by 1/4" long screws, with four lockwashers, tightened into the tapped holes on the underchassis lips.

92. Affix the carrying handle to the chassis top cover by means of the 10–24 by 3/8" long screws. Use appropriate lockwashers.

93. After having installed tubes and crystals, the cover may be fastened onto the chassis by tightening four 6–32 knurled head, thumb screws, with four lockwashers, into the tapped holes on the chassis sides.

94. Thoroughly inspect your work for accuracy of wiring and component placement as well as for quality of soldering.

Upon completion of all construction steps given in this section, the only components remaining should be the octal plug assembly and four coaxial connectors. These pieces are to be used in ST-203-A installation, the octal plug for connecting the power cable to the SO1, and two of the coaxial plugs for connecting pieces of RG-58/U cable, from antenna and receiver, to CR1 and CR2. Two extra coaxial plugs are furnished for antenna connecting purposes at a fixed location, adding to the convenience of quickly installing the ST-203-A there as well as at the mobile site.

INSTALLATION

Installation data for the ST-203-A in a mobile and a fixed station are given in this section of the manual.

MOBILE (DC) OPERATION

A typical arrangement of the components in an automobile follows:

ANTENNA—Mobile antennae are usually made of graduated sections of flexible metal rod and are equipped with base insulation and mounting facilities for attachment to car body or bumper. The better kinds are telescopic permitting accurate adjustment to the exact length desired for the operating frequency and have locking joints so that the length adjustment may be permanently retained.

A quarter-wave, whip antenna suitable for the frequency range of the ST-203-A is generally mounted vertically at the left, rear portion of a car.

TRANSMITTER—The location of the ST-203-A in the luggage compartment should afford proximity to antenna and dynamotor, accessibility for adjustment and removal, and minimum interference with stowage space. In many cases, a satisfactory layout will result with the ST-203-A situated with its left side toward the rear of the car and its back alongside the left wall of the compartment. Sufficient room should remain immediately forward of the transmitter to accommodate the dynamotor longitudinally. The ST-203-A base mounting plate may be fastened directly, or by means of shock absorbing fixtures, to the compartment floor. Enough space should remain between the sidewall of the compartment and the back of the transmitter to permit insertion of the power plug.

POWER UNIT—Either a dynamotor or vibrator pack may be used to power the ST-203-A. The unit must operate from 6 volts DC and should deliver 400–500 volts DC at 160–200 milliamperes, although as little as 300 volts DC at 150 milliamperes could be used with corresponding reduction in transmitter power. The power unit requires a suitable filtering system to eliminate the ripple component in its output voltage and a control relay with contacts of high current carryin capacity to complete the 6 volt input circuit. See Figure 7. Often a power unit will incorporate these features as part of its assembly and, therefore, will not require additiona components. The large relay contacts are needed to handle the high current drawn by the power unit; yet the relay is controlled by a much smaller current via the microphone press-to-talk switch.

Another important item of consideration along with the power unit is the large gauge cable that must be used for wiring to the storage battery. At the high current value likely to be drawn (23 amperes with the PE-

103-A dynamotor), very little cable resistance can be tolerated. Therefore, insulated wire equivalent to no smaller than #8 gauge should be employed and should be routed to minimize, as much as possible, the length required in the car.

On some power units, notably of the vibrator type, one of the input terminals may be grounded internally to the unit's case. Before installing such a pack, it should be determined that the grounded terminal agrees in polarity with that pole of the storage battery bonded to the car's chassis. Otherwise, a short circuit of the storage battery may result.

Should a PE-103-A dynamotor be used, it should be fastened to occupy the space forward of the ST-203-A so that its output socket is toward the transmitter and its battery cables toward the front of the car. This dynamotor has its own high current control relays, protective cricuit-breakers, smoothing filter, and heavy gauge battery cables (approximately eleven feet long).

REMOTE CONTROL—The group of componnets to be affixed in a position handy to the operator-driver, but remote from the transmitter, consists of the filament switch, microphone jack, and one or two indicator lights (both optional). See Figure 7.

The SPST toggle switch may be considered the main power switch to the transmitter as it interrupts the storage battery circuit to the ST-203-A tube filaments and changeover relay, the latter of which controls the high voltage power unit.

The three conductor microphone jack serves as an extension of J2 in the transmitter for remote press-to-talk operation.

A green jewel, pilot light assembly at PL1 indicates when the storage battery circuit has been completed, via switch S, to the transmitter. This light serves merely as an operating convenience and, therefore, it is optional equipment.

A red jewel, pilot light assembly at PL2 indicates when the high voltage power unit is turned on by means of the press-to-talk microphone switch. This light serves merely as an operating convenience and, therefore, is optional along with the extra lead wire to it in the interconnecting cable. See Figure 7.

Generally, an automobile's instrument panel has a bend along its lower edge where the remote control components may be arranged. In some cases, ready punched holes for accessories exist on this strip and no drilling will be required. However, the control parts may be mounted in a small metal case which in turn may be fastened in a convenient position for use as a control box.

Figure 7 suggests the possible use of the car's ignition lock as a master switch for the mobile installation. The advisibility of such usage depends

upon the electrical system in the particular make of car and/or the user's disposition toward what it offers. On some cars, the ignition lock, with the key rotated from center to one side, turns on the ignition, fuel gauge and other circuits but, when rotated to the other side, turns on the fuel gauge (plus certain accessories), minus the ignition.

If the installation car has this arrangement, the lead from power switch S may be connected to the ignition lock switch so as to function with the fuel gauge and, therefore, allow turning on the mobile unit either while running the motor or while parked with the motor off. With the ignition locked and the key removed, the equipment is protected from unauthorized use.

Other cars have ignition locks that do not provide for turning on one circuit to the exclusion of others as well as with the others. In this instance, the ignition lock may be used as a master switch for the mobile unit, but only if the user is satisfied that he cannot turn on the equipment without also completing the ignition circuit.

It should be realized that it is not necessarily advantageous to be able to operate the equipment while the storage battery is not being charged. Almost any dynamotor or vibrator pack that would be used with this transmitter will draw sufficient current to run down the battery in a comparatively short length of time. Unless the operator can limit his transmitter operations to very short tests when the battery is not charging, it is probably safer to connect through the ignition lock so that the equipment is operable only when the ignition and motor are on regardless of the switching arrangement offered by the car.

To avoid interconnecting the radio installation with the ignition lock, route the lead from switch S directly to the "hot" pole of the battery.

RECEIVING EQUIPMENT—No recommendations are given here concerning selection of the receiving equipment. Actual installation will be governed by the form it takes; it may be a complete receiver for the desired frequency range or a converter to be attached to the car's broadcast receiver. In any case, its controls should be within easy reach.

Electrically, it will be linked to the transmitter by means of coaxial cable connecting from the ST-203-A's antenna changeover relay to the antenna input terminal of the receiver. The refinement of "standing-by" the receiver while transmitting may be had providing that the receiver is adaptable to the switching circuit offered by contacts #4, #5 and #6 of RY in the ST-203-A. See CIRCUIT EXPLANATION. These contacts have a maximum rating of 2 amperes.

INTERCONNECTING CABLES—The multi-wire interconnecting cable shown schematically in Figure 7 may be made up of lead wires of different insulation colors, for ease of tracing, laced together with lockstitch cord. In translating the given wire sizes into their equivalents in flexible wire, #20 gauge becomes 10 strands of #30 copper wire and #14 gauge becomes 26 strands of #30 copper wire. Cable plug PL1 which contacts SO1 at the back of the transmitter is supplied with the ST-203-A. If the PE-103-A dynamotor is to be used, cable plug PL2 must be procured for it. See ACCESSORIES.

Two lengths of HG-58/U coaxial cable must be prepared, one short piece to run from the antenna to the connector marked ANT on the ST-203-A and the other piece to run from the receiver's antenna terminal to the connector marked RCVR on the ST-203-A. On the end of each of these cables terminating at the transmitter, one of the provided coaxial plugs should be affixed. This is done by carefully stripping off one inch of the Vinyl covering, removing all but 3/16" of the exposed shielding braid, and skinning off 3/4" of the polyethelyne inner insulation leaving a 3/4" length of the inner conductor bare.

The prepared end of the cable is fed into the plug so that the inner conductor passes through the hole in the prong, and the shielding braid passes inside the metal shell where it is carefully soldered to it. Then the inner conductor is soldered where it protrudes through the prong and trimmed off.

FIXED STATION (AC) OPERATION

Use of the ST-203-A at a fixed location requires a power unit, working from the 115 volt AC line, to deliver 400–500 volts DC at 200 milliamperes and 6.3 volts AC at 2.8 amperes. Such a supply is shown schematically in Figure 6.

Both the transmitter and power unit should be situated for operating convenience. An octal plug assembly, similar to that supplied for the DC installation, should be used at PL1 for connecting the power unit's output cable to SO1 on the ST-203-A.

Referring to the circuit of Figure 6, the closing of S1 turns on the filament transformer permitting the 5R4-GY rectifier tube and ST-203-A tube filaments to heat. The high voltage is then controlled by the press-to-talk switch on the microphone. Closing switch S2 on the power unit will also turn on the high voltage and actuate the antenna changeover relay in the transmitter, however, modulation cannot be produced until the audio input circuit is completed by pressing the microphone switch.

Any antenna system, however simple or elaborate, appropriate for the transmission frequency and fed by coaxial cable may be applied to the ST-203-A. Two extra connector plugs are supplied for ready connection of antenna and receiver to the ST-203-A in the fixed location.

ADJUSTMENT AND OPERATION

WARNING-*Any person who operates or handles this transmitter should be fully aware of and alert to the presence of dangerous electrical potentials. Before removing top or bottom covers from the chassis, for any purpose whatsoever, all power controls should be turned OFF and the power plug detached from the chassis receptacle. In addition, if a PE-103-A dynamotor is used for power, its circuit breakers, behind hinged side-door, should be switched OFF.*

CONTROLS AND CONNECTORS

ST-203-A controls and connectors are employed as follows:

OSCILLATOR KNOB, identified by the marking OSC, is used for rotation of capacitor C3. Resonance of the tank circuit which it tunes is attained when a setting is found that produces a peak amplifier grid current of 2.0 to 2.5 milliamperes on the meter.

AMPLIFIER KNOB, identified by the marking AMP, is used for rotation of capacitor C8. Resonance of the tank circuit which it tunes is attained when a setting is found that produces a minimum amplifier cathode current on the meter, the depth of which varies with the degree of antenna loading.

ANTENNA KNOB, identified by the marking ANT, is used for rotation of capacitor C10. Increasing capacitance in this circuit, increases antenna loading upon the amplifier stage. The correct setting is that which permits the amplifier tube to become loaded up to 65 milliamperes of cathode current with minimum dip adjustment of the AMP knob.

CRYSTAL SWITCH, identified by the marking FREQ, is used for selection of either crystal socket. With the switch lever toward XTL 1, a crystal in the left hand socket is chosen. With the switch lever toward XTL 2, a crystal in the right hand socket is chosen.

METER SWITCH, identified by the marking AMP MA, switches the circuit to show either amplifier grid or cathode current on a milliammeter connected to the jack marked MTR. With the lever toward GRID, the switch is open removing the screen potential from VT2. In this condition, only amplifier grid current can flow, assuming that C3 has been properly

adjusted, and is shown by the meter. When ready to resonate the amplifier tank circuit, the lever should be thrown toward CATH, thus closing the switch to apply the screen potential to VT2. In this condition, the meter shows amplifier cathode current, a combination of plate, screen and grid currents.

MICROPHONE JACK, identified by the marking MIC, serves as a receptacle for the plug on the microphone cord. For remote operation, a duplicating circuit is brought out at SO1.

METER JACK, identified by the marking MTR, serves as a receptacle for a plug on a cord connecting to the milliammeter employed as a tuning indicator.

ANTENNA CONNECTOR, identified by the marking ANT, serves as a receptacle for the plug connecting the coaxial line from the antenna system.

RECEIVER CONNECTOR, identified by the marking RCVR, serves as a receptacle for the plug connecting the coaxial line from the antenna terminal of the receiving equipment.

POWER RECEPTACLE, the octal socket located at the rear of the chassis, is used for introducing power and control circuits to the ST-203-A.

TUNING PROCEDURE

Assuming that the ST-203-A has been readied for operation, e.g., tubes and crystal(s) inserted in proper sockets, top and bottom covers affixed to chassis, and unit properly installed for mobile operation, the tuning procedure may be described. Insert microphone and meter plugs into jacks at front of ST-203-A.

If the car's storage battery is well charged, a quick tune-up is permissible with the motor off, but for a prolonged operating period, the car's generator should be adequately charging the battery.

TO HEAT FILAMENTS, turn on power switch S (and ignition switch if part of circuit) located at operator's remote control position. Allow a one minute warm-up period.

TO TUNE OSCILLATOR, first select XTL 1 or XTL 2 with crystal switch and throw meter switch to GRID position. Depress microphone button to turn on high voltage, and rotate OSC knob to setting providing maximum current reading on meter (2.0 to 2.5 milliamperes). Release microphone button.

TO TUNE AMPLIFIER, throw meter switch to CATH position and set ANT knob for minimum capacitance of C10 (pointer to left). Depress microphone button and quickly rotate AMP knob to setting providing minimum current reading on meter (approximately 20 milliamperes). Release microphone button.

NOTE: When using a channel near the lower limit of the ST-203-A's frequency range, it may be possible to find two settings over the scale of C8 that produce a dip in cathode current. *The correct setting is that which occurs at higher capacitance.* The other setting results from frequency tripling in the amplifier stage.

TO TUNE ANTENNA, depress microphone button and rotate ANT knob to increase capacitance (starting at minimum) until CATH reading on meter rises to 65 milliamperes. Carefully readjust AMP knob to reestablish the point of minimum current, the new level of which is determined by the degree of antenna loading. If the resultant current value drops below 65 milliamperes, increase capacitance with the ANT knob and follow with the retuning of AMP knob for the dip in CATH current. This procedure should be repeated until the antenna system loads up the amplifier tube to 65 milliamperes with the AMP knob set to the point of current dip. Should the ANT knob be set at too high a capacitance and cause CATH current in excess of the amount specified, its capacitance should be decreased to establish the desired current level. Release microphone button.

Having accomplished the tuning procedure, the microphone and meter may be disengaged from the ST-203-A. The microphone may then be inserted into the remote control jack and communications effected from the operator's position.

Microphones designed for use in mobile craft are highly damped to minimize pickup of extraneous background noises. Therefore, close talking is required to develop a high percentage of voice modulation.

It should be realized that an appreciable change in crystal frequency should be followed by readjustment of the oscillator, amplifier, and antenna tuning controls.

Plate power input to the final amplifier tube is easily computed by multiplying the applied plate voltage by the plate current in amperes. The latter is established by subtracting 10 milliamperes from the CATH meter reading (2.5 milliamperes of grid current plus 7.5 milliamperes of screen current). For example, with a plate supply of 500 volts and an amplifier cathode current of 65 milliamperes, the plate power input to the amplifier tube is 27.5 watts, e.g., 500(.065−.01).

When working the ST-203-A from an AC power pack at a fixed location, the tuning procedure is identical to that already described. However, the remote control feature will not be needed and operation may be conducted at the unit itself.

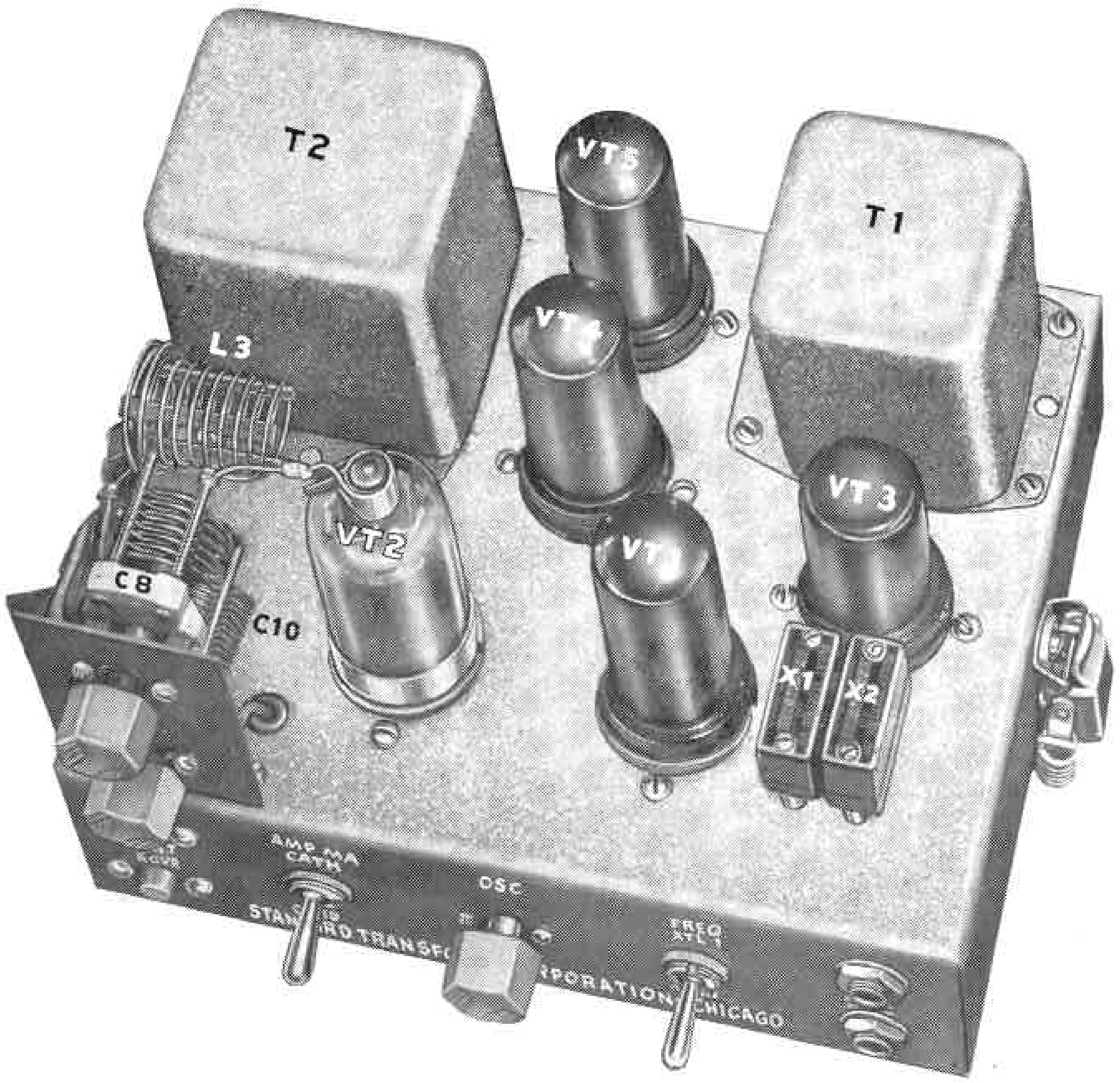


Figure 3. ST-203-A Chassis Top View

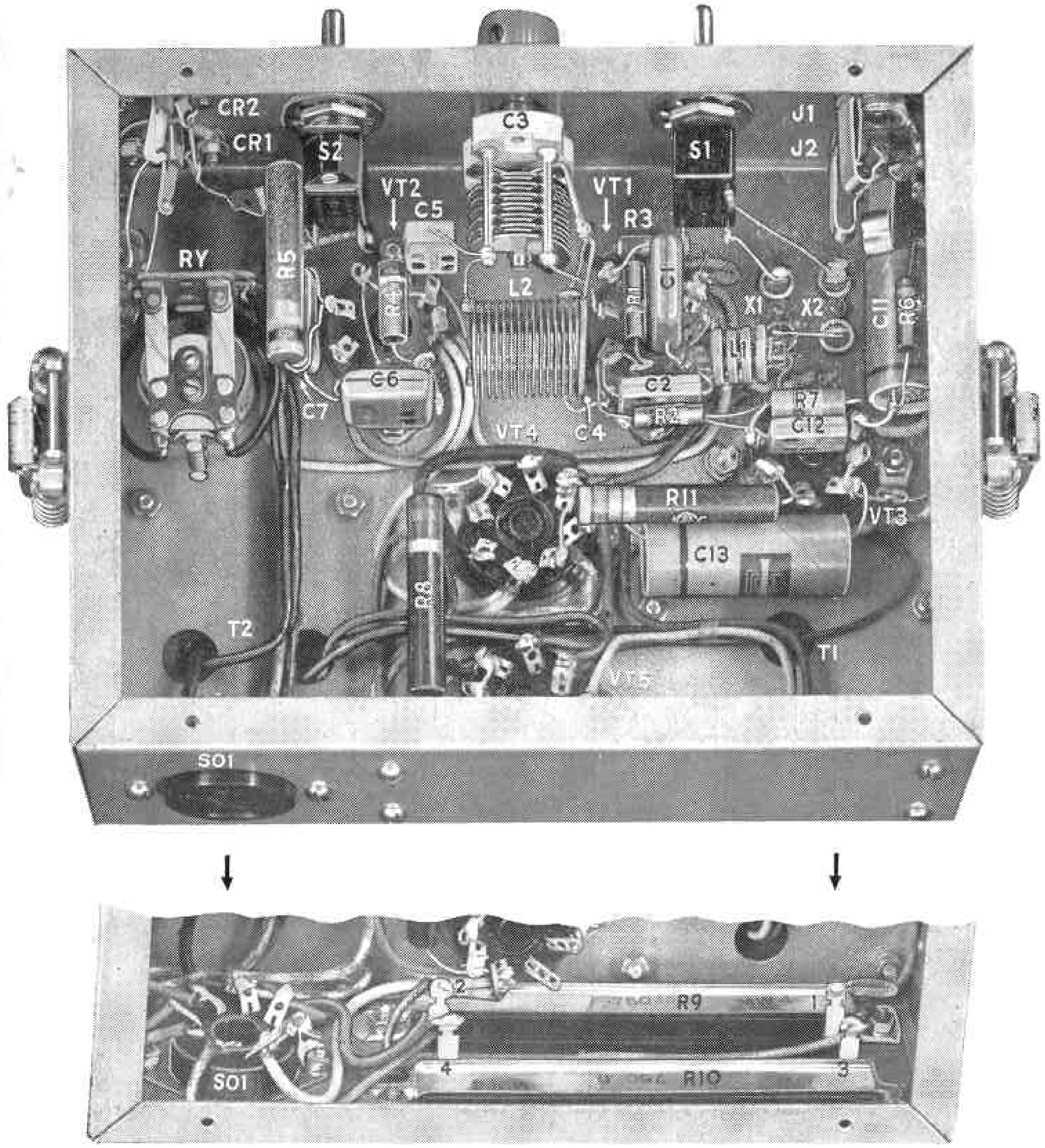
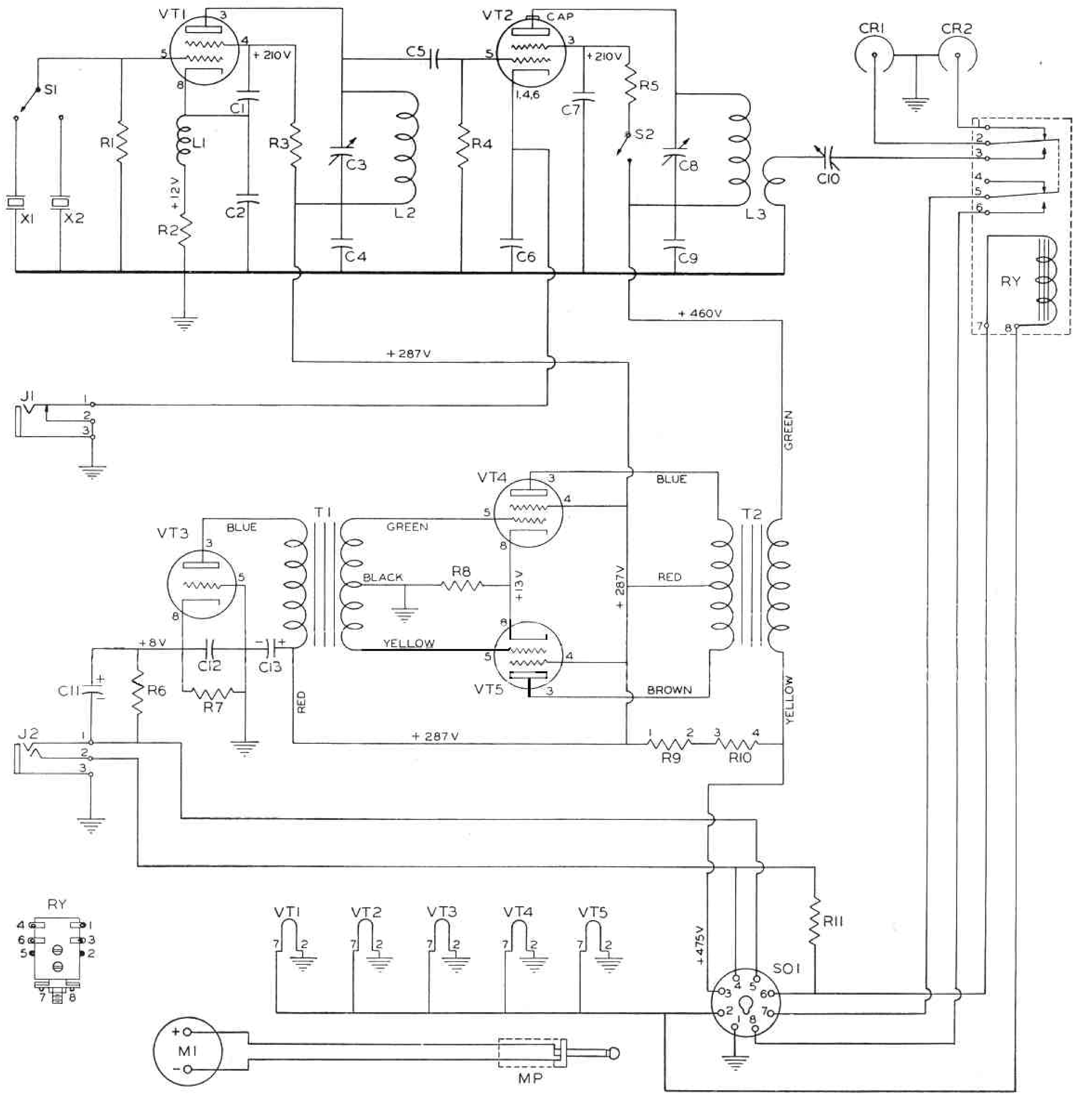


Figure 4. ST-203-A Chassis Bottom View

LEGEND TO ST-203-A SCHEMATIC DIAGRAM

DIAGRAM REFERENCE	DESCRIPTION OF COMPONENT	FUNCTION IN CIRCUIT
C1	2,000 mmfd. 500 WV mica capacitor	Oscillator screen by-pass
C2	100 mmfd. 500 WV mica capacitor	Oscillator regeneration throttler
C3	35 mmfd. .025″ airgap variable capacitor	Oscillator plate circuit tuning
C4	2,000 mmfd. 500 WV mica capacitor	Oscillator plate circuit by-pass
C5	100 mmfd. 500 WV mica capacitor	Oscillator output coupling
C6	2,000 mmfd. 500 WV mica capacitor	Amplifier cathode by-pass
C7	2,000 mmfd. 500 WV mica capacitor	Amplifier screen by-pass
C8	35 mmfd. .025″ airgap variable capacitor	Amplifier plate circuit tuning
C9	1,000 mmfd. 800 WV mica capacitor	Amplifier plate circuit by-pass
C10	75 mmfd. .015″ airgap variable capacitor	Antenna loading of amplifier
C11	10 mfd. 25 WV electrolytic capacitor	Speech amplifier cathode by-pass
C12	100 mmfd. 500 WV mica capacitor	Speech input RF by-pass
C13	4 mfd. 450 WV electrolytic capacitor	Speech amp. plate circuit by-pass
CR1	2 conductor connector	Receptacle for line from antenna
CR2	2 conductor connector	Receptacle for line from receiver
J1	Single closed circuit, 2 conductor jack	Meter plug receptacle
J2	Open circuit, 3 conductor jack	Microphone plug receptacle
L1	2.5 mh. 50 ma. RFC coil	Oscillator regeneration inductance
L2	Air wound inductor	Oscillator plate tank coil
L3	Air wound inductor with link pickup	Amplifier plate tank coil

M1	0–100 DC milliammeter	Tuning indicator
MP	Standard 2 conductor "phone" plug	Connects meter to J1
R1	47,000 ohm ½ watt carbon resistor	Oscillator grid-leak bias
R2	560 ohm ½ watt carbon resistor	Oscillator cathode bias
R3	27,000 ohm ½ watt carbon resistor	Oscillator screen voltage reduction
R4	100,000 ohm 1 watt carbon resistor	Amplifier grid-leak bias
R5	30,000 ohm 2 watt carbon resistor	Amplifier screen voltage reduction
R6	560 ohm ½ watt carbon resistor	Speech amplifier cathode bias
R7	27,000 ohm ½ watt carbon resistor	Speech input circuit shunt
R8	150 ohm 2 watt wirewound resistor	Modulator cathode bias
R9	750 ohm 14 watt wirewound resistor	Plate and screen voltage reduction
R10	750 ohm 14 watt wirewound resistor	Plate and screen voltage reduction
R11	7.5 ohm 2 watt wirewound resistor	Voltage reduction to RY coil
RY	DPDT relay with 6 VAC/2 VDC coil	Ant. switching and power control
S1	SPDT toggle switch	Crystal selector
S2	SPST toggle switch	Amplifier screen voltage gate
SO1	Octal socket	Power and control circuit receptacle
T1	Plate to PP grids audio transformer	Interstage Coupling
T2	PP 6V6's to Class C load mod. transformer	Amplitude modulation of VT2
VT1	Type 6V6 radio tube	Crystal-controlled oscillator
VT2	Type 2E26 radio tube	Class C RF Amplifier
VT3	Type 6J5 radio tube	Speech amplifier
VT4	Type 6V6 radio tube	Audio modulator
VT5	Type 6V6 radio tube	Audio modulator
X1	1st crystal position	Frequency Control
X2	2nd crystal position	Frequency Control



RADIO TRANSMITTER ST-203-A

FEBRUARY 19, 1948

SCHEMATIC DIAGRAM WD-198

DRAWN-R.A.T. APP'D-MO7

INDICATED DC VOLTAGES MEASURED WITH A 5000 OHMS PER VOLT INSTRUMENT BETWEEN POINTS SHOWN AND CHASSIS GROUND

Figure 5. ST-203-A Schematic Diagram

Comment is invited concerning criticisms, suggestions, and experiences of Stancor kit users. Such correspondence should be addressed to The Electronic Equipment Division, Standard Transformer Corporation, Elston, Kedzie and Addison, Chicago 18, Illinois.

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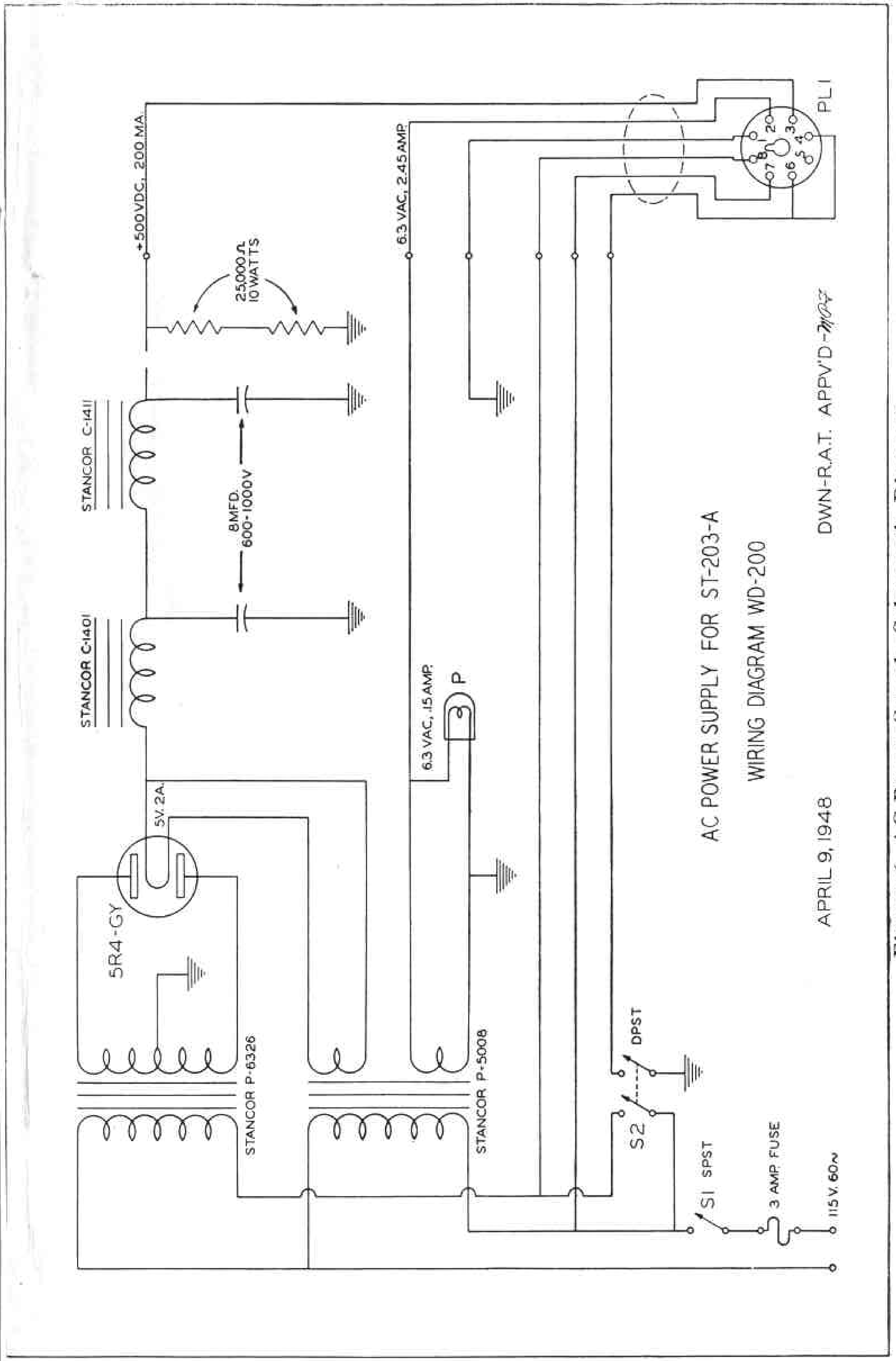

Figure 6. AC Power Supply Schematic Diagram

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